Besides this, it suffers a good deal by the neglect of the Musalmáns, who do not repair it. The door, which has been entirely eaten by worms, opens towards the east, and has a sight of the other two cupolas. They excel in material and handsomeness the others of *Uch*, except that of "Bíbí Jind Vadí."

"Bíbí Jind Vadí" was one of the descendants of Sháh Síad Jalál, of whom I have already spoken. The dome in which she sleeps is erected of burnt bricks, which are cemented by mortar. The whole of the edifice is ornamented by various hues and lapis lazuli of the celebrated mines of *Badakhshán*. The size of this grand building may be estimated at about 50 feet high, and the circumference 25.

Though the clouds had unluckily obscured the light of the day, still we endeavoured to take a sketch of the Bíbí Jind Vadí's mausoleum by means of the camera obscura. I herewith enclose a copy of it—[which we omit for reasons given on a formar occasion.—Ed.]

IX.—*Specimens of the Soil and Salt from the Sámar, or Sambhur lake salt-works. Collected by Lieut.* Arthur Conolly, *and analyzed by Mr.* J. Stephenson.

It is now more than a year since I received from my friend Lieut. A. Conolly the specimens named at the head of this article. They were on a very large scale, and packed up so carefully as to exhibit on arrival, almost as perfect a picture of the process and progress of the salt manufacture at the celebrated lakes of *Sámar*, as could be obtained by a personal visit to the spot.

At my request, Mr. Stephenson submitted such of the specimens as seemed to require it, to chemical examination in my laboratory, and where the results were unexpected, I verified them myself by re-examination. My sole reason for delaying the publication of these very interesting memoranda was, that I was in hopes Lieut. Conolly would favor me with a full account of the manufacture, which, however, public business and subsequently ill health obliged him to postpone—and thus time has crept on until the specimens themselves have nearly dissolved away in the damp air of the last rains; and unless I place on record what I already possess, there will hereafter be no means of consulting the perishable materials to prepare another report.

The labels which accompanied the parcel were so full and explicit, that, when followed by the chemical notes referring to the numbered specimens, they formed nearly as comprehensive a view of the opera-

tion as could be wished: I will therefore first place these before the reader.

Note on Sámar lake salt and earth, by Lieut. A. Conolly.

While acting as Salt Collector for two months at *Sambhur*, I employed part of my time in putting together officially some interesting notes, historical (semi-fabulous rather) and statistical, concerning this marvellous spot, collected by my friend N. B. Edmonstone, Esq. Superintendent of *Ajmír*, when he went to take possession for the Honorable Company at the beginning of the year (1835). Connected therewith it would be desirable to have scientific examination of the produce of the mines, for which purpose I send them to you under charge of a servant; and will here detail the contents of the boxes.

A 1.—A long box containing a quantity of the mud which forms the bed of *Sambhur* lake, and which yields as often as it is covered by (a few inches depth of) water, and acted upon by a hot atmosphere. This mud was dug out before me from the bed of a "*kiyár*" (or vat) just after it had yielded a good crust of salt crystals, when it was of the consistency of a stiff jelly. The mud nearest to the surface was put next to the part of the box at which the lid is laid hold of, (in order that it may be drawn out,) and so on downwards till the box was filled.

A 2.—A box divided into three parts, containing as many sorts of earth. 1st. Some of the black mud just mentioned, which has the depth of about half a *gaz* below the surface of the lake. 2nd. A bluish earth which soon hardens into a friable cake and seems a compound of what lies above and below it. This has a depth of half a *gaz* under the black mud. 3rd. A white sandy earth, which has a depth of from five to six *gaz* under the second strata. This I learned from the *Sambhur* Sherishtahdar who sent the specimens after me to *Jaipúr* on the 10th July. He wrote "under strata No. 3 lies white stone from which chunam is made." I immediately sent off an express to say that I would make the fortune of any enterprising digger who would dive for some of this stone, but the Serishtahdar returned for answer that the attempt had been made in vain, (rain) water having covered the whole surface of the marsh. He dug on the very edge of the lake, where there was no black mud, but only the earth No. 2, and he found nothing but this (he wrote) to the depth of 6 *gaz*, when the influx of water obliged the diggers to give over work. He wrote moreover, some of the "oldest inhabitants say that all parts of the lake are not alike; that in some places you dig and find the three sorts of earth sent; in others, below the mud only '*sang i kuchet*' (?) In others again only mud that has no bottom."

I may further mention that the Serishtahdar wrote—"The people call the *gil i safeid*, *Pindole* (H.) and make whitewash from it." This inducing a belief that it contained lime, I poured vinegar on a bit which immediately effervesced. I fancy this sort of earth is used to make the very delicate porous vessels out of which the better sort of natives drink in summer.

A 3.—Three pieces from the surface of a *kiyár* (vat) off which a crop (crust) of salt had just been raked.

4. A piece of ditto, on which, apparently, the salt did not come out well.

5. A piece of ditto, near the edge on which the salt did not form.

6. A piece of ditto, the salt of which got mixed with scum while forming.

7. A piece which seems to have been similarly mixed, but which was cut from another *kiyár*, and said to be five or six years old. It has evidently been rained upon, and it was taken from under a sheet of rain water, by which more of it would have been melted had it not been old and *pakká*.

8 a.—A piece on the scum of which crystals were formed after rain had fallen upon it.

8 b.—A ditto ditto.

8 c.—A ditto ditto.

9. A piece the salt of which got somewhat mixed with mud when being formed, (probably from its being agitated by a strong wind) and on which a crust of scum settled.

10. A piece of crust, chiefly scum, such as is thrown aside as useless.

11. Other refuse pieces taken from a kiyár in which they had been lying neglected for, perhaps, some years.

12. Pieces of crust of *salt* from the surface of a kiyár.

13. Ditto ditto. N. B. These have been more or less smoothed and thinned by having been rained upon.

14. Bits of a fine crust of salt with a little scum on the top. This was cut with a phaurá from the surface of a kiyár.

14 a. Three other bits of a different kiyár.

14 b. Another of another.

The above five items are merely varieties to enable you to trace the process of formation.

A 15.—"*Bacheh*," or infant crystals, about the smallest size in which the mineral particles come to view on the surface of the salt mud, after the partial evaporation of a body of water covering it. These were taken from under a sheet of water six fingers (or three inches) deep.

16. Crystals about two days old (after first formation) six fingers' depth of water at first, 1½ fingers' depth evaporated when crystals taken out.

17. Ditto about three days old; or when two of six fingers' depth of water had evaporated.

18. Ditto about four days after first formation, or when three of six fingers' water had evaporated.

19. Ditto of a fair (common) size, produced after about eight days' evaporation of six fingers deep water.—N. B. These crystals were found during the hot winds, when the day's heat was intense, and that of the night considerable.

20. Crystals which formed on a stick after it had lain seven days in the six finger water from which the last mentioned (19) were taken after eight days.

21. Ditto. The concretion is more rapid on a thread, or stick, or any thing that the water can get round, than on the surface of the mud.

22. Crystals made in a kiyár in 20 days during the hottest season. 12 fingers' depth of water at first, four remaining when crystals were taken out.

23. Crystals taken from the lake after a complete and uninterrupted evaporation of a body of water five or six, or perhaps more, inches deep.

24. Pink crystals from the surface of the marsh; formed by the rapid evaporation of a shallow deposit (or *puddle*) of water.

A 25.—Good *Sambhur* salt, such as a *byopárí* would call *pakká*, and readily buy.

26. Superior ditto, such as a *byopárí* would *covet*—a year or so old.

B 1.—" The grandfather of all salt" (the literal expression of the man who brought it.) A lump taken out of an old pit eight cubits deep, said to have been re-opened after a lapse of 100 years. In this may be observed several layers, but for which I should have been ready to believe that the diggers had arrived at the top of an under ground chain of salt mountains, such as those beyond the Indus, which ELPHINSTONE describes, and that they had just chipped off a peak. You must know that the bed of the *Sambhur* lake is, for the most part, as shallow as a dish, and that after the rains it gradually becomes dry; *when* dry the natives dig pits a few cubits' depth in the bed of the marsh, and pour the salt water that they thus obtain into vats (made with large stakes, grass, and earth), in which it evaporates in from eight to fifteen days, according to the depth of its sheet, and the state of the weather. A pit is dug for a few rupees, so an old one is not usually restored after the rains: the water deposited in it dries into a cake of salt at its bottom; then a little sand is blown in, and then another rainy season comes, and a second layer is formed, and so on for perhaps many seasons, when, the pit becoming filled, all traces of its contents disappear till the sinker of a fresh well hits upon them.

2. Another lump taken out of another pit three or four cubits deep.

B 3.—Another from another.

4. Another bit from another pit.—N. B. All four specimens were extracted when water was above them.

5, 6, 7. Lump crystals and intermediate strata of earth from other pits.

8 and 9. Loose crystals from a pit four cubits deep.—Ditto from ditto, eight cubits deep.—N. B. You will observe that nearly all the *Sambhur* salt crystals grow into the shape of a four-sided pyramid. I see in the Cyclopedia that the cube is given as the ascertained primitive form of 11 minerals, of which salt is one; please to *dissect* a crystal till you arrive at its nucleus, and if you have leisure, tell me the process of structure, for " *Sakamberí jí*," the tutelary goddess of the Chouhan Rajpúts, for one of whom she in the year 608 S. miraculously made the lake, appears to reverse the order of architecture in putting together her mineral particles, causing them to rise from a point to a base*.

10. A piece from a pit, the crystals of which are slightly coloured.

Examination of selected Specimens from the above. By J. STEPHENSON.

A No. 1.—*Mud from the bed of Sambhur Lake.*

An average portion digested in distilled water, and the filtered solution (which appeared of a reddish brown colour), subjected to the usual tests, gave the following results.

Nitrate of barytes,	Copious white precipitate.
Nitrate of silver,	Ditto flambent grey ditto.
Prussiate of potash,	No change.
Oxalate of ammonia,	Ditto ditto.
Litmus paper,	Ditto ditto.
Turmeric ditto,	Ditto ditto.

* The pyramidal appearance is merely from truncation of the cube. The solid angle of the cube seems to resist solution more than the rest of the crystal.—ED.

300 grains exposed to a gentle heat in order to drive off the moisture lost 107 = 35, 6 per cent.

100 grains of the dry mud was now put into solution, and the insoluble matter collected on the filter, washed, dried, and weighed, gave 70 grains.

The filtered solution treated with nitrate of barytes threw down a precipitate of sulphate of barytes, together with the colouring matter, which after washing, drying, and weighing, gave 17 grains = 10.4 sulphate of soda.

The solution now freed from the sulphate was next treated with nitrate of silver, from which a precipitate of muriate of silver was obtained, weighing 42 grains = 19.5 muriate of soda.

Insoluble matter,	70	0
Sulphate of soda,	10	4
Muriate of soda,	19	5
Loss,	0	1
	100	0

Examination of the insoluble matter from A No. 1, after the separation, as above, of the sulphates and muriates.

Fifty grains of the insoluble earthy matter now freed from the extraneous salts was treated with muriatic acid. A strong effervescence took place, and the digestion was continued for 12 hours, as there was reason to suppose that carbonate of lime was present. It was now repeatedly washed with pure water, and the remaining earthy matter, which the acid had not dissolved, separated and collected on the filter, well dried and weighed: it amounted to 37 grains.

The muriatic solution was now treated with oxalate of ammonia, which threw down a copious precipitate of oxalate of lime. This being well washed, and dried, weighed 11 grains = 8.6 carbonate of lime.

The remaining solution contained a considerable portion of loose muriatic acid, which being neutralized with pure liquid ammonia, a portion of alumina (tinged with yellow oxide of iron) was precipitated. This being separated by the filter, washed, dried, and weighed, gave 4 grains.

Calculating then for per centage, the composition of this earthy matter will stand as follows:

Matter insoluble in muriatic acid (silica,)	74	0
Carbonate of lime,	17	2
Alumina and oxide of iron,	8	0
Loss,	0	8
	100	0

A No. 10.—This I found to be chiefly composed of sulphate of soda, with the carbonate and muriate of soda in considerable proportion.

A No. 15.—This gave a trace of sulphate; otherwise good salt; though the crystals are small.

A No. 22.—When tasted gave traces of sulphate.

A No. 24.—Crystals of a pink colour, which disappear in the filtered solution; the colouring matter appears to be volatile—sulphate of soda predominates in this sample; no carbonate of soda present.

B No. 1, *from an old deep pit re-opened after* 100 *years. Examination by tests.*

Nitrate of silver,	Copious precipitate.
Nitrate of barytes,	Very copious ditto.
Oxalate of ammonia,	No change.
Prussiate of potash,	Ditto ditto.
Litmus paper,	Ditto ditto.
Turmeric ditto,	Ditto ditto.

A fair average sample was taken through the whole thickness of the lump.

100 grains exposed to a gentle heat lost 5.5 grains moisture.

100 grains treated with nitrate of barytes gave a precipitate, which after having been well washed and dried, weighed 136 = 83 sulphate of soda.

The filtered solution treated with nitrate of silver produced a precipitate of chloride of silver, which after having been well washed and dried, weighed 22 grains = 10.4 muriate of soda.

The composition of this sample is then as follows:

Insoluble matter,	1	0
Moisture,	5	5
Sulphate of soda, (and carbonate?)	83	0
Muriate of soda,	10	4
Loss,	0	1
	100	0

A No. 6.—The salt of which got mixed with scum while forming, appeared very wet.

When tested, this sample appeared to contain a considerable portion of alkali, especially the reddish coloured part called *scum* in the list.

100 grains dissolved, and the insoluble matter separated by the filter, washed and dried, gave 2 grains.

To the filtered solution was added acetic acid till the alkali became neutralized; after which it was treated with nitrate of barytes; the sulphate of barytes was precipitated, and having been well washed and dried, weighed 84 grains = 51 sulphate of soda.

Nitrate of silver threw down a precipitate of chloride of silver that weighed (after washing and drying) 30 grains = 14 muriate of soda.

In order to ascertain the quantity of alkali in this sample, 100 grains were dissolved in pure water, and treated (drop by drop) with sulphuric acid of specific gravity 1.116 till the exact point of saturation was ascertained, by frequently testing with litmus paper. Towards the point of saturation a strong effervescence took place. The solution was neutralized after 96 grains of the acid test liquor had been used, which is equal to 10 per cent. of carbonate of soda.

This sample being very wet, the moisture was ascertained in the usual way, and amounted to 23 per cent.

This sample, or rather what is called *scum* in the list, is composed of

Sulphate of soda,	51	0
Muriate of soda,	14	0
Carbonate of soda,	10	0
Insoluble matter,	2	0
Moisture,	23	0
	100	0

Samples A Nos. 25 and 26, called good and superior salt in the list, when tested, gave traces of sulphate; with this exception the crystals are good and pure.

The conclusions to be drawn from the preceding details are somewhat at variance with the general impression regarding the *Sambhur* salt lakes. At least my own idea, derived from conversation with natives engaged in the salt traffic, was, that the lake water was a deep saturated brine, which left so thick a cake of salt on evaporation in the hot weather, that it was cut out in blocks on the margin and brought away on bullocks.

It would seem, however, that the shallow lake, or inundation would of itself, leave a deposit too thin to be profitably worked; and that it is customary to dig reservoirs or *kiyárs* wherein several feet depth of water already nearly concentrated to brine, are allowed to deposit their crystals on drying; or the evaporation is aided by the introduction of sticks, up which the saline incrustation rapidly creeps.

The velocity of the spontaneous evaporation under the fierce sun and scorching winds of the western desert, is well exemplified by specimens A 15, the *bacheh* or infant crystals of one day's growth, through 16, 17, 18, to 19, the 8th day's produce; in the last the crystals are cubes of full half an inch base. Again we find crystals of the same size in No. 22, from the evaporation of 8 out of 12 fingers' depth of water in 20 days of the hottest season. In No. 23 the crystals from 6 inches depth of water are of $\frac{3}{4}$ inch base. The *size*, however, of the crystals depends greatly upon the undisturbed continuation of the process, and does not give us a clue to the quantity of salt deposited from a given depth of water, whence we might calculate the saltness of the lake itself at various periods of the season. The rate of evaporation itself may be estimated from the above data tolerably well; thus—"6 fingers in 8 days"—"12 fingers in 20 days"—will be nearly *half an inch in depth per diem!* The pits dug for the reception of the brine seem sometimes to be very deep, 10 or 12 feet; in these when deserted the deposit proceeds for several years, forming solid strata of salt separated by a streak of earth washed in during the rainy season. The accumulation is then dug out in mass: but in general the salt for sale is collected as it forms in the brine pits in a granular state, by which means it is freed from the more soluble salts with which it is accompanied. The *pakká* salt of the *byopáris* or traders (Nos. 25, 26), is of a large grain—the latter indeed in half-inch crystals,—and not very clean.

A circumstance of chief importance elicited by Lieut. Conolly's specimens, is the presence of the carbonate and sulphate of soda in considerable abundance among the saline products of the *Sambhur* lake. The greater part of the substance described by the manufacturers as *refuse* or scum, which is stated to be thrown away as useless, turns out on analysis to be carbonate of soda, contaminated with sulphate and muriate; and it is well deserving of inquiry, whether the discovery of so extensive a store of *natron* in a state of great purity, may not be turned to profitable account. In all the strata cut from the neglected *kiyárs* the carbonate is seen overlying the mixed sulphate and muriate, of an efflorescent snowy consistence. Sometimes the formation of the salt is prevented by its abundance as (in A 4, 5, 6); No. 5, I find on analysis to contain 40 per cent. of carbonate, with 30 of each of the other salts—and a little care in separating the crystals of these would leave it nearly pure.

Spicular crystals resembling nitre are seen in some of the specimens (A 11); they bear a very small proportion to the general mass. It is but necessary to refer to Mr. Stephenson's examination of other specimens, to form a clear idea of the conditions best suited for the separation and collection of the different salts; thus in the old deserted pits (B No. 1), the sulphate is obtained nearly pure: in A 6, 10, it is mixed with carbonate; in A 5, the latter predominates. As for the muriate, from its inferior solubility, this salt is readily separated in a state of purity from the brine.

The small proportion of lime in the earthy residue of A 1, from the bed of the lake, rather militates against the expectation entertained by Lieutenant Conolly from native report, of a subjacent stratum of this mineral.

The points now wanted to complete Lieutenant Conolly's description of the *Sambhur* salt manufacture, and the questions naturally induced from the information he has already given, are:

1. A topographical account of the lakes, their extent, general depth, position relatively to adjacent plains, sands, or hills.

2. The extent of the manufacture, produce, possible increase, price, and other statistical data.

3. Whether the carbonate and sulphate are worked and used? the quantity and price of these.

4. The exact process followed by the native manufacturers or collectors.

5. The specific gravity of the water, both of the lake and of the brine pits, at different seasons; which may be found in the absence of the means of determining it on the spot, by bottling off a portion

at stated times. This would also enable us to ascertain whether the carbonate existed in the water, or whether it was formed during the evaporation, by the action of the lime or other earths. The presence of magnesia, of potash, and of iodine also remains an undecided point, as well as the nature of the pink or amethystine colouring matter remarked in some of the specimens (A No. 24).

To conclude this hasty note, I may mention that I have found M. Gay Lussac's alkalimeter a very convenient instrument for examining these mixed salts. By preparing three standard bottles of dilute nitric acid, nitrate of barytes, and nitrate of silver, adapted to his centesimally-divided dropping glass, the per centage of carbonate, sulphate, and muriate, is obtained successively from the same specimen with great ease and rapidity.

J. P.

X.—*Remarks on a collection of Plants, made at Sadiyá, Upper Assam, from April to September,* 1836. *By* William Griffith, *Assistant Surgeon, Madras Establishment, on duty in Upper Assam.*

The following remarks may not be uninteresting, as they concern a portion of India of which, especially so far as regards its natural productions, but little is known. I must beg, however, to point out that they must be considered as outlines only of a slight sketch; since the amount of plants collected in *Assam* does not probably exceed 1,500, and this can scarcely be considered more than one-fourth of its whole Flora.

The greater portion of *Assam* that I have seen, may be compared to an extensive plain, intersected in various manners by belts of jungle, the breadth of which, although extremely variable, does not, except towards the hills enclosing the valley, seem to be often very great. But as we approach towards the eastern boundary, the spots unoccupied by jungle become fewer and less spacious: so that between *Kujoo Ghat* on the *Noa Dehing*, and *Nungroo* on the *Booree Dehing*, and in the whole of that direction, the country is almost exclusively occupied by jungle. The characters of a plain intersected by narrow belts of jungle is very obvious about *Sadiyá*, at which place the collection was almost entirely formed.

The peculiar feature of *Assam*, especially its lower and central divisions, consists in the vegetation of its churs, or tracts of sand, very often of great extent, which are stretched along the *Burhampootur*. The breadth of these tracts, taken together, is, in some places, from 8